would speedily be replaced by that of the three D's, — drill, drawing, and (a)droitness. At the close, Mr. J. R. Lowell, the American minister, speaking as an ex-professor of Harvard, moved a vote of thanks; which was seconded (in French) by Mr. Buisson, director of primary education in France. Mr. Auguste Couvreur of Belgium supported the motion; thanking also Lord Carlingford and Mr. Mundella, the English government representatives of the education department, for their presence there that day. There were about fifty foreign delegates from twelve countries (including Japan and Brazil), attending this conference, the proceedings of which will be published in the course of the autumn. The conference, after being opened by Lord Reay, divided itself into four sections, which sat simultaneously from ten to one and from two to five for five days; and we conclude this article with a list of some of the more important subjects on which papers were read and discussed. 1°. The conditions of healthy education; 2°. Infant training and teaching; 3°. Technical teaching of all kinds (by Professor Woodward, St. Louis, U.S.A., among others); 4°. The methods of teaching the different branches of physical and natural science in elementary and other schools; 5°. The teaching of music; 6°. Museums, libraries, etc.; 7°. Training of teachers; 8°. Inspection and examination of schools; 9°. Organization of elementary education; 10°. Organization of intermediate and higher education; 11°. Organization of university education; 12°. On the teaching of agricultural science.

William Lant Carpenter.

RAILWAY-SIGNALS AT THE ELECTRICAL EXHIBITION.

Among the interesting features of the Electrical exhibition are the different systems of automatic electric railway-signals, designed to render collisions and wrecks impossible. One system, already in quite extensive use, is there illustrated in its application to the running of trains on the block system, on both single and double tracks, to the approaches of a crossing of two roads at the same grade, and to various combinations of switches and signals, whereby a signal cannot be set so as to 'clear' a train until the switch has first been turned in the proper direction, and by this very motion has automatically unlocked the signal-lever. If through any obstruction or failure in the connections the switch is not thrown clear over to its proper position, the automatic electric unlocking action will not respond, and the signal cannot be turned to let the train proceed. The application to a crossing of two roads at grade is very ingenious. The four approaches are guarded by switches, always left open when not in use; so that a runaway locomotive, or other destructive intruder, would be switched round upon a side curve, out of harm's way, as far as the crossing is concerned; and the signals are locked fast at 'danger' as long as these switches are open. Upon the approach of a train from any of the four directions, it announces itself in the signal-house while still at a considerable distance; and then, if the crossing is clear, and there is no previous announcement from either of the other three directions, the signal-man in his lookout-house turns a lever, which, by pneumatic action, closes the switch for the approaching train. This same lever-motion locks all the other switches open; so that the man could not, if he would, let any other train approach the crossing till this one had passed. If the switch closes safely, an automatic electric circuit unlocks the danger-signal lever for this one switch. The man then turns it, and then clears the track for the oncoming train, which can thus pass safely without stopping. If trains approach, meanwhile, from other directions, the danger-signals and open switches — which the signal-man himself cannot unlock till the train has passed the switch beyond the crossing, and automatically unlocked them — prevent any other train from getting to the crossing.

In running upon the block system, it is so arranged that a train entering upon each section, automatically closes there a green warning-signal and a red danger-signal for any following train. As it leaves the section, it automatically signals back, and opens the red danger-signal, but leaves the green warning-signal till it has left the next section, two blocks ahead. The action of a train, then, in leaving one section and entering on another, is to set the two signals there, and to signal back one block to open the red signal, and two blocks to open the green. The engineer of a following train, upon seeing a green signal, will know that a train is somewhere on the section next but one ahead of him, and will run cautiously; and if, upon reaching the next signal, he finds both the green and the red, he must stop till the train ahead has opened the red one. Upon a single-track road a similar set of signals is given, on the other side of the track, for two blocks ahead as well as behind the train. The automatic train-signals are all given through pairs of insulated rails, across which any pair of car-wheels will close an electric circuit; and they are so arranged, that, if the battery fails, the signal goes to danger through the action of gravity, and so remains till the trouble is remedied. This system depends principally, for safety, upon the watchfulness and certainty of the engineer in reading the signals correctly.

Another company exhibits a system which in some respects is superior to this in avoiding the danger from sleepy or inattentive engineers, or from the difficulty of reading the signals in stormy or foggy weather, and the trouble from batteries giving out or getting weak. Each locomotive carries its own battery in the shape of a dynamo, driven constantly by a small steam-en-

gine, whether the locomotive is at rest or running. One pole of the dynamo is connected to the locomotive, and the other to the tender, which is electrically insulated from the former except through this connection; and the circuit is normally completed through the rails on which the wheels of both are resting or running. In this circuit, within reach of the engineer, is a pair of coils whose armature is tightly held as long as the circuit is closed; but, when it is broken, the armature is drawn away, and opens the valve of a shrill whistle; and it stays away, though the circuit may close again and the whistle continues sounding, until the engineer reaches out and presses the armature up to the coils again, thus compelling his attention and voluntary action to stop the whistle. At any point or series of points in the line, where it is desired to signal to or from the approaching train, pairs of rails are inserted, electrically insulated from each other; so that, during the instant while the locomotive-wheels are on one pair and the tender-wheels on the other, the circuit will be broken and the alarm-whistle set going, unless these rails are otherwise connected.

They are thus connected by wires leading from the pairs of such rails ahead to any desired points, — to signal-stations, to switches, to drawbridges, to culverts, or bridges, or any part of the track or road-bed liable to be washed away or rendered dangerous. Thus, so long as the signal-man does not open this circuit, so long as the switch or drawbridge is not open, and the culvert, bridge, and road-bed are safe, the circuit keeps closed through these loops, the engineer gets no signal, and he runs on with confidence. But if any thing is wrong ahead, or if the man in the signal-tower wishes to signal the oncoming engineer, these loops will be open, the circuit will be broken, and the whistle set going till the engineer voluntarily stops it. Moreover, the instantaneous current sent from the dynamo over these loops when closed can signal the approach of a train, from as far as desired, to the signal-man at a crossing, to the train-despatcher, to the switch or bridge tender: in fact, to any points from one end of the line to the other the continuous flashes of this dynamo-current can be made a perfect tell-tale of the progress of the train. Moreover, these same currents can be made to lock switches and drawbridges ahead of the approaching train from pairs of rails preceding the danger-signal ones; and the engineer can thus confidently approach such places at full speed, knowing that no careless or confused switchman or bridge-tender or evil-disposed train-wrecker can have thrown these open after he has passed the locking signal-rails, and then, from another pair of rails beyond, the dynamo unlocks them after the train has passed. A signal on the throttle-valve lever warns the engineer if he attempts to run out of the round-house without starting up the dynamo, and any subsequent failure in the dynamo also, of course, blows the warning-whistle till it is set right. This system, in which each locomotive is its own unfailing battery, has certainly important advantages, especially in compelling the attention and voluntary action of the engineer whenever danger is ahead.

THE COMMITTEE REPORTS OF THE AMERICAN ASSOCIATION.

ALTHOUGH several committees were discharged last year for making no report, there were no less than eleven to be called on at the session on Monday morning. Of these, six made no response whatever: others, only a verbal and partial statement. The following reports are of general interest: —

Dr. E. B. Elliott of Washington, the chairman of the committee on the registration of births, deaths, and marriages, said that this committee was created many years ago to petition the United States congress for the establishment of a system of registration of births, deaths, and marriages. Since many states have established systems of registration of their own, the committee has petitioned, not for a separate system, but for the co-operation of the general government in securing uniformity and efficiency in the several state systems.

The first report of the committee on stellar magnitudes (Proc. Amer. assoc., xxx. p. 1) included a plan for the determination of standards for stars fainter than the tenth magnitude. Twenty-four bright equatorial stars were chosen; and the standards were to be selected from the regions following them from two to six minutes of time, and not differing in declination from the leading stars by more than five minutes of arc. The second report presented this year consists of charts of all the stars visible with the fifteen-inch telescope used at the Harvard college observatory, in all but three of the regions from which the standards are to be selected. These observations have been verified by the fifteen-inch telescope of the Washburn observatory. The report was referred to the publication committee.

The committee to confer with committees of foreign associations for the advancement of science, with reference to an international convention of scientific associations, reported that they had succeeded in conferring with a like committee from the British association.

A motion to have the committee discharged, as it had completed its task, having been made, Prof. H. Carvill Lewis of Philadelphia asked whether the committee might not continue to be efficient in extending courtesies from our own association to kindred foreign associations. Many gentlemen felt that some steps should be taken whereby members of our association going to England may become members of the British association while there, and a like courtesy be extended to members of the British association while in America. He therefore suggested that the action on the motion to discharge the committee be deferred for the present, in the expectation that arrangements would be made for the holding of joint meetings by the two great associations.

Mr. Trelawney Saunders of London, Eng., said he should like to respond in a few words to the kindly sentiments that had been expressed from the platform. As an Englishman, he said that he was delighted to hear the sentiment — a general sentiment, he thought, or it would not have been ex-